|  |
| --- |
| **Lesson Plan Template** |
| Grade Level(s)Primary/Secondary Content Topic: Add and Subtract/Integers |
| Key: SW = Students will TW = Teacher will HOTS=Higher-order Thinking Skills |
| Lesson Title: Hot and Cold Cubes |

|  |
| --- |
| Content Standard: ACOS #1 |
| Content Source: Interactive Mathematics Program |

|  |  |
| --- | --- |
| Key Vocabulary | Materials, Equipment, Supplies |
| * Integers | * Hot/Cold Cube Signs for Student Demonstration |
| * Positive | * Colored Pencils |
| * Negative | * Homemade Cubes or Colored Tiles |
| * Zero Pairs | * String/Rope |
|  | * Chef Hat (Optional) |
|  | * Cauldron (Optional) |
| HOTS: *List higher-order questions, skills or activities included in this lesson.* | |
| * Write your own problems to practice with a partner. | |
| * Write a different analogy that could work that explains why “minus a negative” is the same as adding. | |
| * Write the “rules” in your own words. | |

|  |
| --- |
| Connections with Prior Knowledge/Building Background |
| * Basic addition and subtraction skills |
| * Real world experiences with number |

|  |  |
| --- | --- |
| Content Objectives | |
| Source | Objectives in Student-friendly Language |
| ACOS | 1. Simplifying numerical expressions |
| Language Objectives | |
| Source | Objectives in Student-friendly Language |
| WiDA | Standard 3: English language learners **communicate**  information, ideas and concepts necessary for academic success in the content area of **Mathematics** |
|  |  |
| Blended Content-Language Objectives | |
| Students will add and subtract integers using manipulatives | |
|  | |

|  |
| --- |
| Meaningful Activities and Peer-to-Peer Interactive Oral Techniques (IPOTS) |
| * TPR – Students will visualize adding and subtracting integers through Total Physical Response |
| * Manipulate colored tiles to visualize the addition and subtraction of integers. |

|  |
| --- |
| Review/Assessment |
| * You *can* assess students on the hot/cold cubes, but the story is really there to help them remember WHY the rules exist. Some students do not enjoy using the hot/cold cubes, so I usually don’t test them on actually using the manipulatives, only the concepts behind them. A good suggestion is to let a bonus question be about the manipulatives. |
| * The homework each night serves as a review of the concept for that day. This lesson was for an Algebra 1 class, so if you needed to slow it down, you could beef it up with more examples. |

|  |
| --- |
| Wrap-Up |
| * Key Vocabulary: Integers, positive, negative, zero pairs |
| * Key Concepts: what happens to the temperature if you add cold cubes (add a negative)? What happens to the temperature if you take out cold cubes (subtract a negative)? |

|  |  |  |  |
| --- | --- | --- | --- |
| Group Member | Group Member | Group Member | Group Member |
| Ave Jack | Emily Murray | Lyn MacQueen | Candace Ferrell |

|  |  |  |
| --- | --- | --- |
| Vignette | | |
| Grade Level(s) | Content-area | Content Topic |
| 9th Grade | Algebra 1 | Integers |

|  |  |  |
| --- | --- | --- |
| ELP Level(s) | All |  |
|  |  |  |

|  |
| --- |
| General Description of Lesson |
| Begin the lesson by presenting the story of the magic chefs. Ask for student volunteers to be the hot/cold cubes in the story. You will need to make hot/cold cube signs by placing a plus or minus sign on red and blue paper – you can tie it around the neck with a string. Complete the basic questions in the story using students as the hot and cold cubes. Allow the students to demonstrate being in the cauldron. Use rope/string as the cauldron. Discuss how zero pairs cancel one another out (students can pair up one hot cube with one cold cube and exit the cauldron). The number of cubes left in the cauldron is the final answer to the problem. For instance, if there are four cold cubes, then the answer is negative four (-4).  After the demonstration, allow students to work in groups to complete a few examples of their own using homemade hot/cold cubes, manipulatives, or simply drawing it with red and blue colored pencils. Allow the groups the time to try and work out the problems on their own.  Towards the end of the lesson, you may wish to stress how 3 + (-4) = -1 (add three hot cubes and add four cold cubes) and how 3 – (-4) is 7 (add 3 hot cubes and take out four cold cubes). Eventually, students will no longer use the manipulatives, but you may still wish to have them write out the scenario. The lesson also continues into multiplying and dividing with integers for subsequent lessons. In summary, allow the students to create their own “rules” when adding and subtracting integers: Same signs, add the numbers and keep the sign. Different sign, subtract and keep the sign of the larger number. |

|  |
| --- |
| Differentiation Supporting English Language Proficiency Levels |
| Students with extremely lower English Language Proficiency levels could simply show a problem using the manipulatives or colored pencils to answer questions. They may also use arrows to explain if the temperature would go up or down. |

|  |
| --- |
| Teacher Notes (process, procedure, safety, hints, tips…) |
| * If you do not have colored tiles, you may wish to have the students make their own hot and cold cubes using grid paper and colored pencils. * When it comes to subtracting a negative, do not focus so much on the manipulatives. Instead, explain how “taking out (subtracting) cold cubes (a negative) would cause the temperature to go up. * Some students will not enjoy using the manipulatives. This is okay. They can still use their words to express the meaning. This story is to help students remember why the rules exist. |

The Chefs Hot and Cold Cubes

Addition and Subtraction

From the IMP Curriculum

Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

You may have learned some rules for doing arithmetic with positive and negative numbers. Many people find these rules hard to remember and don’t understand where the rules come from.

The following mythical story provides a context for understanding how positive and negative numbers work. Many people find it easy to remember the story many years after they first heard it, and the memory of the story enables them to reconstruct the rules. The story also helps some people make sense of the rules.

The Story

In a far-off place, there was once ea team of amazing chefs who cooked up the most marvelous food ever imagined.

They prepared their meals over a huge cauldron, and their work was very delicate and complex. During the cooking process, they frequently had to change the temperature of the cauldron in order to bring out the flavors and cook the food to perfection.

The cold cubes were similar to ice cubes except they didn’t melt, and the hot cubes were similar to charcoal briquettes, except they didn’t lose their heat.

If the number of cold cubes in the cauldron was the same as the number of hot cubes, the temperature of the cauldron was 0 degrees on the temperature scale.

For each hot cube that was put into the cauldron, the temperature went up one degree; for each hot cube removed, the temperature went down one degree. Similarly, each cold cube put in lowered the temperature one degree and each cold cube removed raised it one degree.

The chefs used positive and negative numbers to keep track of the changes they were making to the temperature.

For example, suppose 2 hot cubes and 3 cold cubes were dumped into the cauldron. Then the temperature would be lowered by 1 degree all together, since 2 of the 3 cold cubes would balance out the 2 hot cubes, leaving 1 cold cubes to lower the temperature 1 degree.

They would write

(+2) + (-3) = -1

to represent these actions and their overall result.

Similarly if they added 3 hot cubes and then removed 2 cold cubes, the combined result would be to raise the temperature 5 degrees. In that case, they would write

(+3) - (-2) = +5.

And if they wrote

(-5) - (+6) = -11,

it would mean that the first 5 cold cubes were added and then 6 hot cubes were removed, and that the combined result was to lower the temperature 11 degrees.

Sometimes they wanted to raise or lower the temperature by a large amount, but did not want to put the cubes into the cauldron one at a time. So for large jumps in temperature, they would put in or take out bunches of cubes.

For instance, if the chefs wanted to raise the temperature 100 degrees, then they might toss five bunches of 20 hot cubes each into the cauldron instead of 100 cubes one at a time. This saved a lot of time because they could have assistant chefs do the bunching.

1. Each of the problems below describes an action by the chefs. Figure out how the temperature would change overall in each of these situations and write an equation to describe the action and the overall result.
   1. Three cold cubes were added and 5 hot cubes were added.
   2. Five hot cubes were added and 4 cold cubes were removed.
2. Describe the action involving hot or cold cubes that is represented by each of the following arithmetic expressions and state how the temperature would change overall.
   1. (+4) – (-3)
   2. (-6) + (-4)

Homework #1: Do It The Chef’s Way



Explain each problem in terms of the model of hot and cold cubes. Your explanation should describe the action and state how the temperature changes overall in each case.

1. (-6) + (-9)
2. (-4) – (+6)
3. (-7) – (-10)
4. (+3) + (-7)
5. (+8) – (-12)

The Chefs Hot and Cold Cubes

Multiplication and Division

When the chefs used bunches of cubes to change the temperature, they used a multiplication sign to record their activity. For example, to describe tossing five bunches of 20 hot cubes each into the cauldron, they would write

(+5) \* (+20) = +100

where the (+5) meant that five bunches were being added, and the (+20) showed that there were twenty hot cubes in each bunch.

The chefs could also change the temperature by removing bunches. For example, if they removed three bunches of 5 hot cubes each, the result was to lower the temperature 15 degrees, because each time a bunch of 5 hot cubes was removed, the temperature went down 5 degrees. To record this change, they would write

(-3) \* (+5) = -15

where the (-3) meant that three bunches were being removed, and the (+5) showed that there were five hot cubes in each bunch.

1. Each of the problems below describes an action by the chefs. Figure out how the temperature would change overall in each of these situations and write an equation to describe the action and the overall result.
   1. Two bunches of 6 cold cubes each were added.
   2. Four bunches of 7 hot cubes each were removed.
   3. Three bunches of 6 cold cubes each were removed.
2. Describe the action involving hot or cold cubes that is represented by each of the following arithmetic expressions and state how the temperature would change overall.
   1. (-10) \* (-5)
   2. (+4) \* (-8)

Homework #2: Do It The Chef’s Way



Explain each problem in terms of the model of hot and cold cubes. Your explanation should describe the action and state how the temperature changes overall in each case.

1. (-3) \* (-4)
2. (+5) \* (-2)
3. (-6) \* (+9)
4. What did you notice about the use of number words (seven) and number symbols (7)? What reasons could the authors have for representing numbers in these different ways at different times?
5. Describe how you could explain why a negative multiplied by a negative is a positive.
6. This lesson is entirely about discovery. What can you add to this lesson to make it more concrete?